WHAT IS CLAIMED IS:

1. An isolation bearing for supporting a superstructure relative to a base, said isolation bearing comprising:

an isolation axis;

a lower plate adapted for attachment to said base, said lower plate having an upwardly facing bearing surface;

an upper plate adapted for attachment to said superstructure, said upper plate having a downwardly facing bearing surface;

a pair of sidewall members fixed to said lower plate to define a pair of opposing wall surfaces extending parallel to said isolation axis of said bearing;

a roller situated between and in rolling contact with said upwardly facing bearing surface of said lower plate and said downwardly facing bearing surface of said upper plate;

at least one of said upwardly facing bearing surface and said downwardly facing bearing surface being configured to provide a normal reference position of said roller along said isolation axis toward which said roller is biased under gravitational loading; and

non-linear damping means for providing a damping force for dissipating kinetic energy associated with displacement of said lower plate relative to said upper plate along said isolation axis, said damping force being a non-linear function of the velocity of said lower plate relative to said upper plate.

2. The isolation bearing according to claim 1, wherein said upwardly facing bearing surface has a generally V-shaped profile.

3. The isolation bearing according to claim 1, wherein said pair of sidewall members are designed to withstand a lateral load equal to or greater than the vertical load supported by said isolation bearing.

4. The isolation bearing according to claim 38, wherein each of said pair of sidewall members includes a friction track removably attached thereto for defining said pair of opposing wall surfaces, whereby the coefficient of friction between said sliding guides and said wall surfaces is selectable by installing suitable friction tracks.

5. The isolation bearing according to claim 38, wherein each of said pair of sliding guides includes a friction plate removeably attached thereto, whereby the coefficient of friction between said sliding guides and said wall surfaces is selectable by installing suitable friction plates.

6. The isolation bearing according to claim 1, wherein at least one of said pair of sidewall members is fixed to said lower plate in a releasable manner to enable relief of said frictional force.

7. The isolation bearing according to claim 1, further comprising a locking mechanism for preventing motion of said upper plate relative to said lower plate along said isolation axis incident to horizontal loading below a predetermined threshold.

8. The isolation bearing according to claim 7, wherein said locking mechanism allows a limited range of motion of said upper plate relative to said lower plate along said isolation axis prior to locking.

9. The isolation bearing according to claim 7, wherein said locking mechanism comprises:

a first member fixed relative to said upper plate, said first member having a pin hole therethrough;

a second member fixed relative to said lower plate, said second member having an elongated travel slot proximately overlapping with said pin hole; and

a locking pin extending through said pin hole and said travel slot.

10. The isolation bearing according to claim 9, wherein said locking pin includes a coupled nut and bolt.

11. The isolation bearing according to claim 7, wherein at least one of said pair of sidewall members includes a threaded hole extending therethrough, and said locking mechanism comprises a bolt extending through said threaded hole for engaging said upper plate to provide a frictional locking force that is adjustable.

12. The isolation bearing according to claim 1, wherein said non-linear damping means includes a linear spring having one end connected to said lower plate and another end connected to said upper plate.

13. The isolation bearing according to claim 12, wherein said linear spring includes means for adjusting a spring constant thereof.

14. The isolation bearing according to claim 1, wherein said non-linear damping means includes a nonlinear spring having one end connected to said lower plate and another end connected to said upper plate.

15. The isolation bearing according to claim 14, wherein said nonlinear spring is a hardening spring.

16. The isolation bearing according to claim 15, wherein said hardening spring includes an initial dead zone wherein there is no spring force associated with displacement of said upper plate relative to said lower plate, and a secondary dead zone after said primary dead zone wherein said spring force increases linearly with displacement of said upper plate relative to said lower plate.

17. An isolation bearing for supporting a superstructure relative to a base, said isolation bearing comprising:

an X isolation axis and a Y isolation axis orthogonal to said X isolation axis;

a lower plate adapted for attachment to said base, said lower plate having an upwardly facing bearing surface;

an intermediate plate having a downwardly facing bearing surface and an upwardly facing bearing surface;

an upper plate adapted for attachment to said superstructure, said upper plate having a downwardly facing bearing surface;

a pair of lower sidewall members fixed to said lower plate to define a pair of opposing wall surfaces extending parallel to said X isolation axis;

a pair of upper sidewall members fixed to said upper plate to define a pair of opposing wall surfaces extending parallel to said Y isolation axis;

lower roller situated between and in rolling contact with said upwardly facing bearing surface of said lower plate and said downwardly facing bearing surface of said intermediate plate; and

an upper roller situated between and in rolling contact with said upwardly facing bearing surface of said intermediate plate and said downwardly facing bearing surface of said upper plate;

at least one of said upwardly facing bearing surface of said lower plate and said downwardly facing bearing surface of said intermediate plate being configured to provide a normal reference position of said lower roller along said X isolation axis toward which said lower roller is biased under gravitational loading; and

at least one of said upwardly facing bearing surface of said intermediate plate and said downwardly facing bearing surface of said upper plate being configured to provide a normal reference position of said upper roller along said Y isolation axis toward which said upper roller is biased under gravitational loading.

18. The isolation bearing according to claim 39, wherein said lower roller and said upper roller are cylindrical rollers, and said non-linear damping means includes:

a pair of sliding guides carried one at each opposite end of said lower cylindrical roller for respectively engaging said pair of opposing wall surfaces defined by said pair of lower sidewall members for providing frictional force opposing relative motion between said lower roller and said pair of lower sidewall members; and

a pair of sliding guides carried one at each opposite end of said upper cylindrical roller for respectively engaging said pair of opposing wall surfaces defined by said pair of upper sidewall members for providing frictional force opposing relative motion between said upper roller and said pair of upper sidewall members.

19. The isolation bearing according to claim 18, wherein said downwardly facing bearing surface of said intermediate plate has an inverted generally V-shaped profile and said upwardly facing bearing surface of said intermediate plate has a generally V-shaped profile.

20. The isolation bearing according to claim 18, wherein each of said pair of lower sidewall members includes a respective friction track removably attached thereto for defining said pair of opposing wall surfaces, whereby the coefficient of friction between said sliding guides associated with said lower roller and said wall surfaces defined by said lower sidewall members is selectable by installing suitable friction tracks.

21. The isolation bearing according to claim 18, wherein each of said pair of upper sidewall members includes a respective friction track removably attached thereto for defining said pair of opposing wall surfaces, whereby the coefficient of friction between said sliding guides associated with said upper roller and said wall surfaces defined by said upper sidewall members is selectable by installing suitable friction tracks.

22. The isolation bearing according to claim 18, wherein each of said pair of sliding guides associated with said lower roller includes a friction plate removeably attached thereto, whereby the coefficient of friction between said sliding guides associated with said lower roller and said wall surfaces defined by said lower sidewall members is selectable by installing suitable friction plates.

23. The isolation bearing according to claim 18, wherein each of said pair of sliding guides associated with said upper roller includes a friction plate removeably attached thereto, whereby the coefficient of friction between said sliding guides associated with said upper roller and said wall surfaces defined by said upper sidewall members is selectable by installing suitable friction plates.

24. The isolation bearing according to claim 18, wherein said frictional force associated with said sliding guides carried by said lower roller differs from said frictional force associated with said sliding guides carried by said upper roller.

25. The isolation bearing according to claim 18, further comprising a locking mechanism for preventing motion of said intermediate plate relative to said lower plate along said X isolation axis incident to loading directed along said X isolation axis below a predetermined X axis threshold and for preventing motion of said intermediate plate relative to said upper plate along said Y isolation axis incident to loading directed along said X isolation axis below a predetermined Y axis threshold.

26. The isolation bearing according to claim 25, wherein said locking mechanism is independently releasable with respect to said X isolation axis and with respect to said Y isolation axis.

27. The isolation bearing according to claim 26, wherein at least one of said pair of lower sidewall members includes a threaded hole extending therethrough, and said locking mechanism comprises a bolt extending through said threaded hole for engaging said intermediate plate to provide a frictional locking force that is adjustable.

28. The isolation bearing according to claim 26, wherein at least one of said pair of upper sidewall members includes a threaded hole extending therethrough, and said locking mechanism comprises a bolt extending through said threaded hole for engaging said intermediate plate to provide a frictional locking force that is adjustable.

29. The isolation bearing according to claim 17, wherein said lower roller and said upper roller are subjected to restorative biasing forces of different magnitudes for biasing said lower roller and said upper roller toward their respective axial reference positions.

30. The isolation bearing according to claim 29, wherein said downwardly facing bearing surface of said intermediate plate has an inverted generally V-shaped profile that is symmetrical about said reference position along said X isolation axis and is characterized by a first slope angle, said upwardly facing bearing surface of said intermediate plate has a generally V-shaped profile that is symmetrical about said reference position along said Y isolation axis and is characterized by a second slope angle, and said first and second slope angles differ in magnitude.

31. The isolation bearing according to claim 39, wherein said non-linear damping means includes:

at least one X-axis spring having one end connected to said lower plate and another end connected to said intermediate plate, said X-axis spring being aligned to act in a direction parallel to or coincident with said X isolation axis; and

at least one Y-axis spring having one end connected to said intermediate plate and another end connected to said upper plate, said Y-axis spring being aligned to act in a direction parallel to or coincident with said Y isolation axis.

32. The isolation bearing according to claim 31, wherein said at least one X-axis spring includes a linear spring and said at least one Y-axis spring includes a linear spring.

33. The isolation bearing according to claim 31, wherein said at least one X-axis spring includes a hardening spring and said at least one Y-axis spring includes a hardening spring.

34. The isolation bearing according to claim 1, wherein said roller is a cylindrical roller having a pair of opposite ends respectively facing said pair of opposing wall surfaces, and said non-linear damping means comprises a sliding guide carried at one of said opposite ends of said cylindrical roller for engaging a respective one of said pair of opposing wall surfaces for providing frictional force.

35. The isolation bearing according to claim 34, wherein said non-linear damping means comprises a pair of sliding guides carried one at each opposite end of said cylindrical roller for respectively engaging said pair of opposing wall surfaces for providing frictional force.

36. The isolation bearing according to claim 17, further comprising non-linear damping means for providing an X axis damping force for dissipating kinetic energy associated with displacement of said lower plate relative to said intermediate plate along said X isolation axis and a Y axis damping force for dissipating kinetic energy associated with displacement of said intermediate plate relative to said upper plate along said Y isolation axis, said X axis damping force being a non-linear function of the velocity of said lower plate relative to said intermediate plate and said Y axis damping force being a non-linear function of the velocity of said intermediate plate relative to said upper plate.

37. A seismically isolated structure comprising:

an isolation axis;

a base;

an upwardly facing bearing surface fixed relative to said base;

a superstructure;

a downwardly facing bearing surface fixed relative to said superstructure;

a roller situated between and in rolling contact with said upwardly facing bearing surface and said downwardly facing bearing surface;

at least one of said upwardly facing bearing surface and said downwardly facing bearing surface being configured to provide a normal reference position of said roller along said isolation axis toward which said roller is biased under gravitational loading; and

non-linear damping means for providing a damping force for dissipating kinetic energy associated with displacement of said base relative to said superstructure along said isolation axis, said damping force being a non-linear function of the velocity of said base relative to said superstructure.

38. The seismically isolated structure according to claim 37, wherein said non-linear damping means includes means for frictional damping.

39. The isolation bearing according to claim 37, wherein said non-linear damping means includes a visco-elastic damper.

40. The isolation bearing according to claim 37, wherein said non-linear damping means includes a linear spring.

41. The isolation bearing according to claim 40, wherein said linear spring includes means for adjusting a spring constant thereof.

42. The isolation bearing according to claim 37, wherein said non-linear damping means includes a nonlinear spring.

43. The isolation bearing according to claim 42, wherein said nonlinear spring is a hardening spring.

44. An isolation bearing for supporting a superstructure relative to a base, said isolation bearing comprising:

a lower plate adapted for attachment to said base, said lower plate having an upwardly facing bearing surface;

an upper plate adapted for attachment to said superstructure, said upper plate having a downwardly facing bearing surface; and

a roller situated between and in rolling contact with said upwardly facing bearing surface of said lower plate and said downwardly facing bearing surface of said upper plate;

wherein at least one of said upwardly facing bearing surface and said downwardly facing bearing surface is a cylindrical surface.

45. The isolation bearing according to Claim 44, wherein one of said upwardly facing bearing surface and said downwardly facing bearing surface is a cylindrical surface, and the other of said upwardly facing bearing surface and said downwardly facing bearing surface has a generally V-shaped profile.

46. The isolation bearing according to Claim 45, wherein said generally V-shaped profile is characterized by a smoothly curved transition zone across an imaginary vertex of said generally V-shaped profile, wherein said transition zone has a radius of curvature that is greater than a radius of said roller .

47. The isolation bearing according to Claim 46, wherein said transition zone is defined by a non-metallic damping insert.

48. The isolation bearing according to Claim 47, wherein said damping insert is formed of rubber or viscoelastic material.

49. An isolation bearing for supporting a superstructure relative to a base, said isolation bearing comprising:

a lower plate adapted for attachment to said base, said lower plate having an upwardly facing bearing surface;

an upper plate adapted for attachment to said superstructure, said upper plate having a downwardly facing bearing surface; and

a roller situated between and in rolling contact with said upwardly facing bearing surface of said lower plate and said downwardly facing bearing surface of said upper plate;

wherein at least one of said upwardly facing bearing surface and said downwardly facing bearing surface has a generally V-shaped profile characterized by a smoothly curved transition zone across an imaginary vertex of said generally V-shaped profile, said transition zone having a radius of curvature that is greater than a radius of said roller.

50. The isolation bearing according to Claim 49, wherein said transition zone is defined by a non-metallic damping insert.

51. The isolation bearing according to Claim 50, wherein said damping insert is formed of rubber or viscoelastic material.

52. The isolation bearing according to Claim 49, wherein one of said upwardly facing bearing surface and said downwardly facing bearing surface has said generally V-shaped profile, and the other of said upwardly facing bearing surface and said downwardly facing bearing surface has a flat profile.

53. The isolation bearing according to Claim 50, wherein one of said upwardly facing bearing surface and said downwardly facing bearing surface has said generally V-shaped profile, and the other of said upwardly facing bearing surface and said downwardly facing bearing surface has a flat profile.

54. The isolation bearing according to Claim 49, wherein both of said upwardly facing bearing surface and said downwardly facing bearing surface have a generally V-shaped profile characterized by a smoothly curved transition zone across an imaginary vertex thereof, said transition zone having a radius of curvature that is greater than a radius of said roller.

55. The isolation bearing according to Claim 54, wherein each said transition zone is defined by a non-metallic damping insert.

56. The isolation bearing according to Claim 55, wherein each said damping insert is formed of rubber or viscoelastic material.

57. The isolation bearing according to Claim 52, wherein said upwardly facing bearing surface is coated by a layer of damping material.

58. The isolation bearing according to Claim 52, wherein said downwardly facing bearing surface is coated by a layer of damping material.

59. The isolation bearing according to Claim 49, wherein an external surface of said roller is coated by a layer of damping material.

60. The isolation bearing according to Claim 57, wherein an external surface of said roller is coated by a layer of damping material.

61. The isolation bearing according to Claim 58, wherein an external surface of said roller is coated by a layer of damping material.

62. The isolation bearing according to Claim 61, wherein said upwardly facing bearing surface is coated by a layer of damping material.

63. An isolation bearing for supporting a superstructure relative to a base, said isolation bearing comprising:

a lower plate having an upwardly facing bearing surface;

an upper plate having a downwardly facing bearing surface;

a roller situated between and in rolling contact with said upwardly facing bearing surface of said lower plate and said downwardly facing bearing surface of said upper plate, at least one of said upwardly facing bearing surface and said downwardly facing bearing surface having a generally V-shaped profile; and

guide means for maintaining rolling motion of said roller relative to said upwardly facing bearing surface and rolling motion of said roller relative to said downwardly facing bearing surface along a common travel axis.

64. The isolation bearing according to Claim 63, wherein said roller has an axis of rotation extending laterally relative to said travel axis, and said guide means acts between said roller and said lower plate, and between said roller and said upper plate.

65. The isolatiuon bearing according to Claim 64, wherein said guide means comprises said roller having a change in diameter along said axis of rotation and said lower and upper plates each having a lateral configuration complementary to that of said roller.

66. The isolation bearing according to Claim 65, wherein said roller has a curved lateral configuration.

67. The isolation bearing according to Claim 65, wherein said roller has a lateral configuration defined by a cylindrical portion located between a pair of opposite conical or frusto-conical portions.

68. The isolation bearing according to Claim 65, wherein said roller has a lateral configuration defined by a first cylindrical portion and at least one second cylindrical portion greater in diameter than said first cylindrical portion.

69. The isolation bearing according to Claim 65, wherein said roller includes at least one circumferential groove arranged to engage a corresponding track on said lower plate and a corresponding track on said upper plate.

70. The isolation bearing according to Claim 63, wherein said roller has an axis of rotation extending laterally relative to said travel axis, and said guide means acts between said roller and one of said lower plate and said upper plate, and between said lower plate and said upper plate.

71. The isolation bearing according to Claim 70, wherein said guide means comprises a pair of sidewalls fixed to said one of said lower plate and said upper plate, each of said pair of sidewalls extending parallel to said travel axis, and said roller is located between said pair of side walls such that each opposite end of said roller is proximate to a respective one of said pair of sidewalls.

72. The isolation bearing according to Claim 64, wherein said guide means comprises means acting between said lower plate and each opposite end of said roller for synchronizing rotation of one end of said roller with the other end of said roller in rolling motion of said roller relative to said upwardly facing bearing surface.

72. The isolation bearing according to Claim 64, wherein said guide means comprises means acting between said lower plate and each opposite end of said roller for synchronizing rotation of one end of said roller with the other end of said roller in rolling motion of said roller relative to said upwardly facing bearing surface.

73. The isolation bearing according to Claim 64, wherein said guide means comprises means acting between said upper plate and each opposite end of said roller for synchronizing rotation of one end of said roller with the other end of said roller in rolling motion of said roller relative to said downwardly facing bearing surface.

74. An isolation bearing for supporting a superstructure relative to a base, said isolation bearing comprising:

a lower plate having an upwardly facing bearing surface;

an upper plate having a downwardly facing bearing surface;

a roller situated between and in rolling contact with said upwardly facing bearing surface of said lower plate and said downwardly facing bearing surface of said upper plate, one of said upwardly facing bearing surface and said downwardly facing bearing surface having a generally V-shaped profile and the other of said upwardly facing bearing surface and said downwardly facing bearing surface having a flat profile; and

guide means for maintaining rolling motion of said roller relative to said bearing surface having said flat profile such that said relative rolling motion is maintained along a predetermined travel axis.